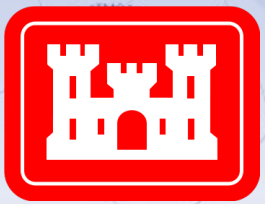


Coordination of Federal Geospatial Work: The National Spatial Reference System

Juliana Blackwell, Director
National Geodetic Survey, NOAA

February 2, 2010

NGS's Role and Authority vis-à-vis "The NSRS"

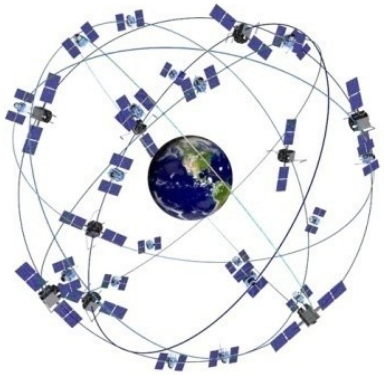
- **OMB Circular A-16 (revised):**
- Names DOC and NOAA as "lead agency" for Geodetic Control, and says:
- *"All NSDI framework data and users' applications data require geodetic control to accurately register spatial data."*
- *"The National Spatial Reference System is the fundamental geodetic control for the United States."*

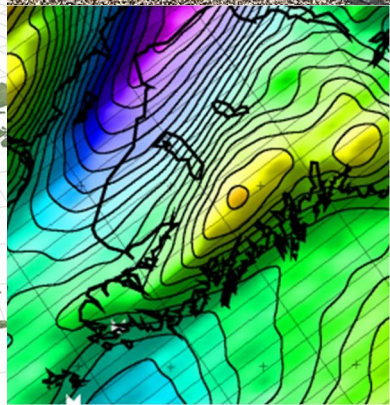
NGS Mission Statement

To define, maintain and provide access to the **National Spatial Reference System** (NSRS) to meet our nation's economic, social, and environmental needs.

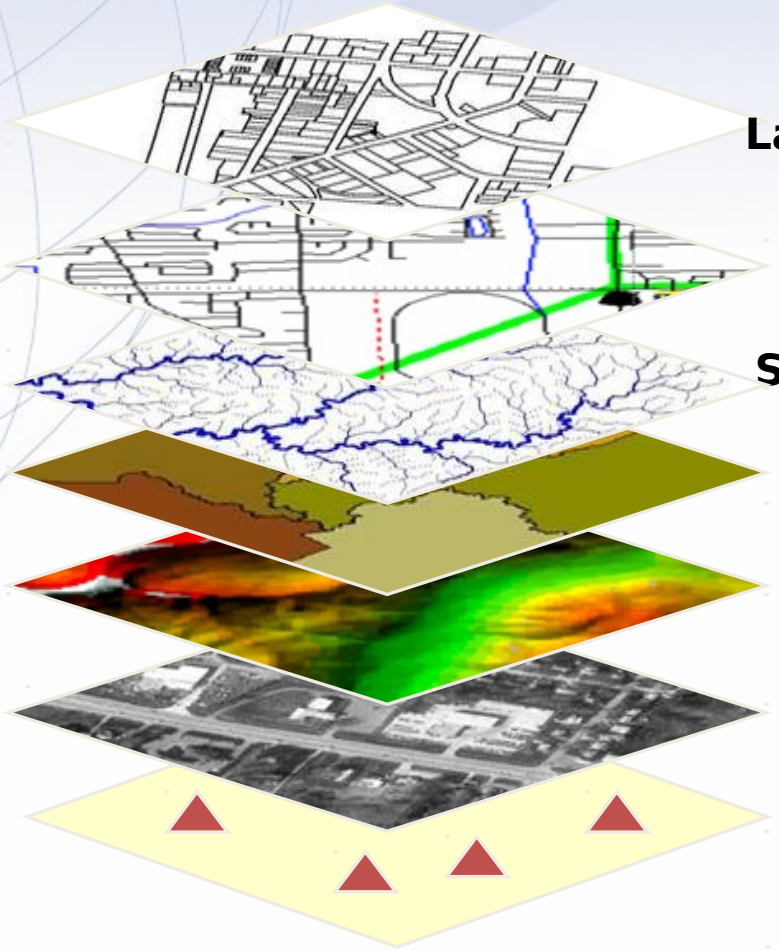
National Spatial Reference System (NSRS)

The NSRS is a consistent coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States. It includes the current datums N
83 and NAVD 8





NGS Provides the Geospatial Foundation for a Wide Variety of Activities



Land Ownership

Transportation

Surface Waters

Boundaries

Elevation

Aerial Imagery

Geodetic Control

FGCS-issued Federal Register Notices Regarding NSRS Use

- **Use of the NAD 83 / WGS 84 Datum Tag on Mapping Products** *(August 14, 1995)*
  (http://www.ngs.noaa.gov/PUBS_LIB/FedRegister/FRdoc95-19408.pdf)

- **Affirmation of Datum for Surveying and Mapping Activities** *(June 13, 1989; NAD83)*
  Affirm North American Datum of 1983 (NAD 83) as the official horizontal datum for all U.S. surveying and mapping activities performed or financed by the federal government.
  (http://www.ngs.noaa.gov/PUBS_LIB/FedRegister/FRdoc89-14076.pdf)

- **Affirmation of Vertical Datum for Surveying and Mapping Activities** *(June 23, 1993; NAVD88)*
  Affirms North American Vertical Datum of 1988 (NAVD 88) as the official civilian vertical datum for surveying and mapping activities in the United States performed or financed by the Federal Government.
  (http://www.ngs.noaa.gov/PUBS_LIB/FedRegister/FRdoc93-14922.pdf)

"To the extent practicable, legally allowable, and feasible, require that all Federal agencies using or producing vertical

Horizontal Datum – NAD 83

The North American Datum of 1983 (NAD 83) is the current horizontal control datum.

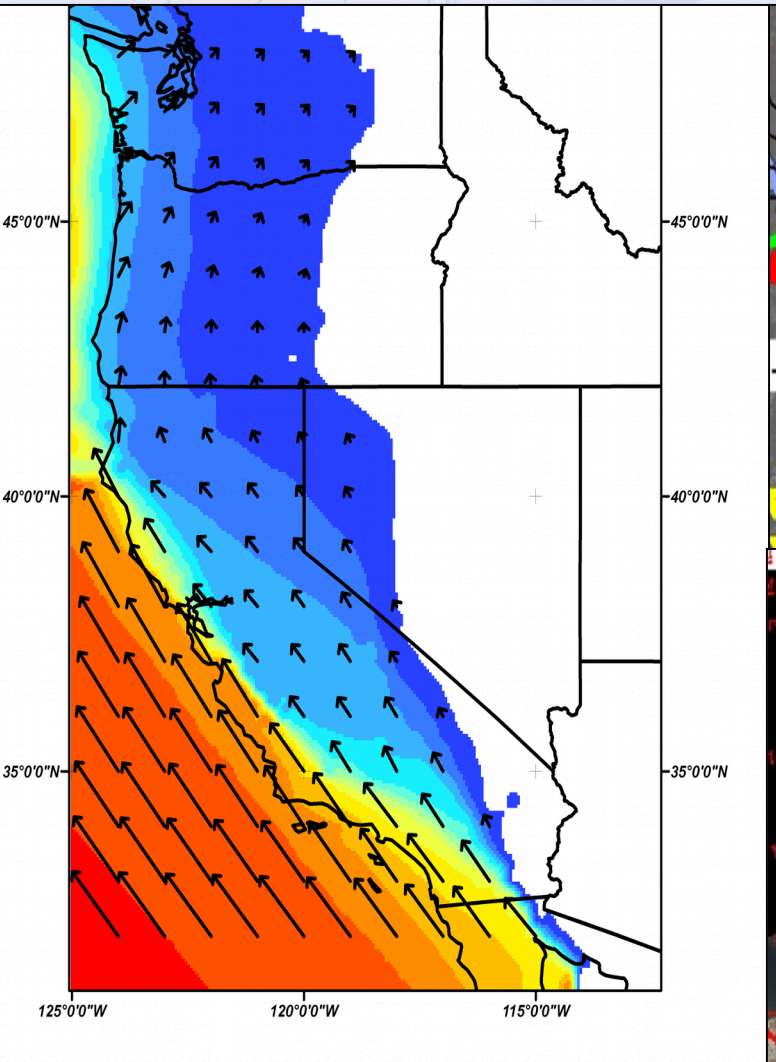
Vertical Datum - NAVD 88

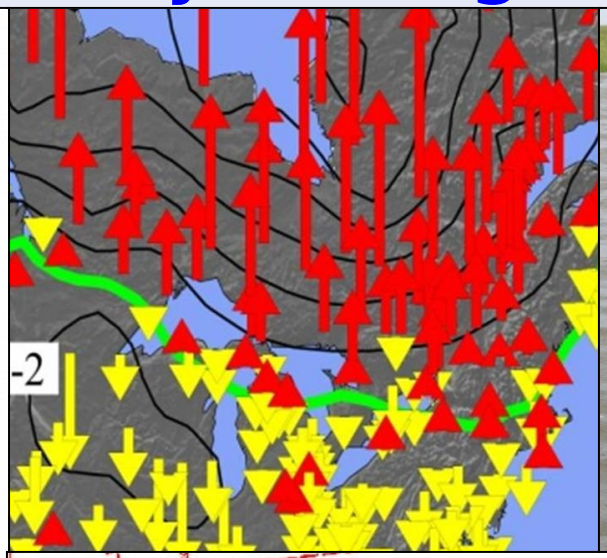
The North American Vertical Datum of 1988 (NAVD 88) is the current vertical control datum.

Why aren't NAD 83 (horizontal) and NAVD 88 (vertical) good enough anymore?

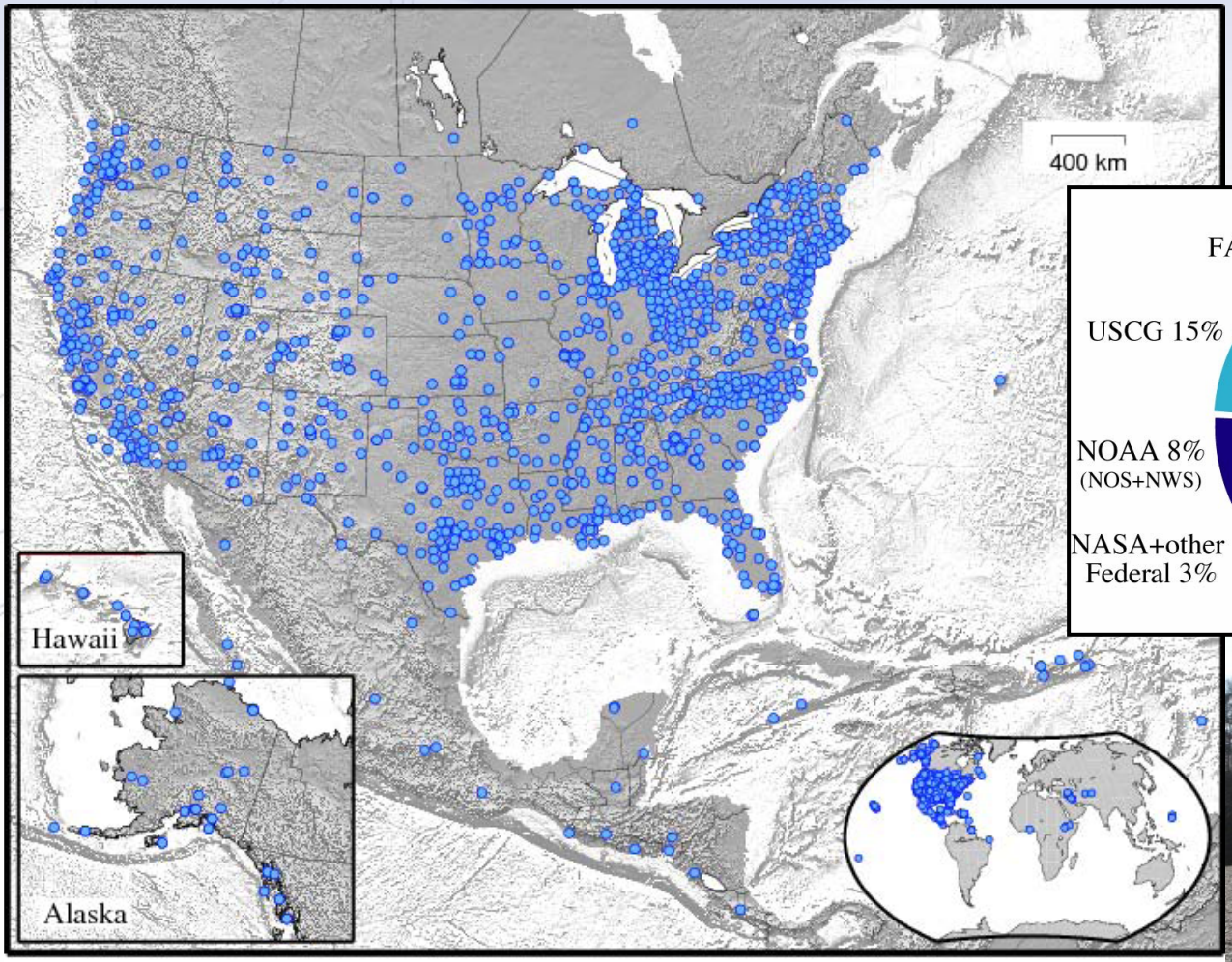
- Differential GPS positioning (from CORS) has made access to latitude and longitude fast and accurate, removing the need to define the datum through passive control.
- NAD 83 was defined in a pre-GPS era, resulting in a 2.2 meter non-geocentricity relative to ITRF – this translates to -2 to +2 meter errors in latitude, longitude and ellipsoid height around the global territories of the USA.
- The GPS era brought fast, accurate ellipsoid hei
  naturally this drove a desire for fast, accurate
  orthometric heights.
- Leveling the country cannot be done again.
  - Too costly in time and money.
  - Yields cross-country errors.
  - Relies on a fragile, unmonitored, poorly distributed set of passive marks.

Constant monitoring of position and height is important because the Earth constantly changes

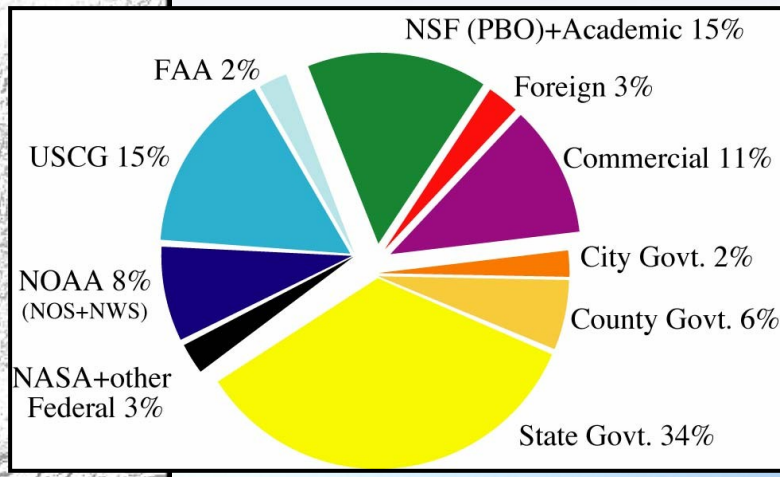




Continuously Operating Reference Stations (CORS)



- ~1,370 Stations
- Grows by ~200 new stations a year.



USACE Levee Inventory

- Working with USACE to utilize a common datum (NAVD 88) on all 12,000 miles of levees.
- Advocating the use of VDatum for accurate water levels and geodetic data.
- Writing procedures for obtaining heights at various accuracy needs.
- Developing training materials for USACE personnel.
- OPUS-DB will allow USACE to see historical GPS solutions (**and thus monitor changes**) over time.

Courtesy of Tulane University

Replacing NAVD 88: GRAV-D

Why Change?

- **The Earth's crust is in constant motion** displacing the positions of many vertical bench marks (NAVD 88).
  - Benchmarks set in the ground move with the ground.
  - Finding an old benchmark might be worse than not finding it, if the "known" (published) elevation hasn't been updated.
- GPS derived heights (ellipsoid heights) only provide half of the picture. High accuracy gravity data is needed to determine the geoid (geoid undulation – the other half).
- Gives users a starting orthometric height from GNSS anywhere (without finding an inconvenient, unmonitored passive mark), from which leveling and mapping may be conducted.

San Joaquin Valley

Gravity for the Redefinition of the American Vertical Datum (GRAV-D)

- *Airborne gravity survey (10 years)*
- *Geoid monitoring into the future*
- *Coastal areas surveyed first*
- *All USA states and territories*
- ***www.ngs.noaa.gov/GRAV-D***

Goals:

- *Orthometric heights good to 2 cm anywhere, anytime from GNSS technology*
- *Height changes easily monitored using **new vertical datum expected to be complete around 2022**.*

Implementation:

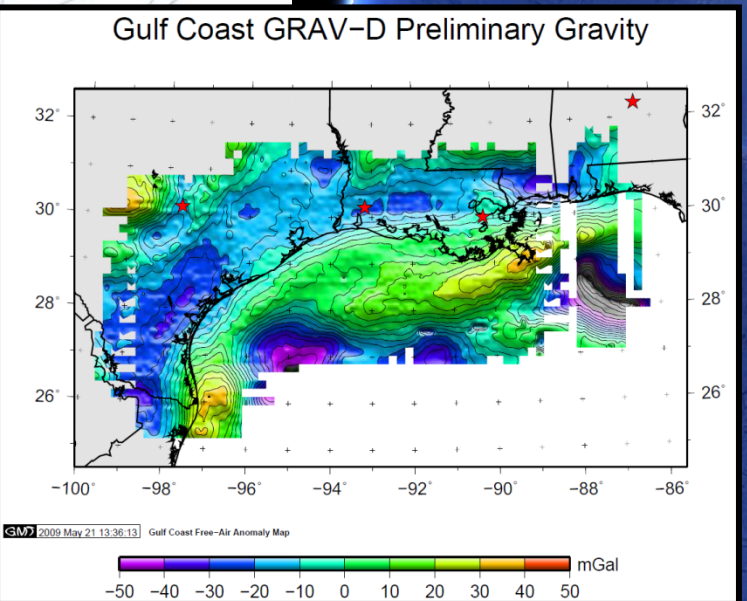
- GRAV-D requires $6M / year to be complete by 2018
- FY 2010 funding - $3.5M
- Seeking collaboration with 7 other federal agencies with a stake in GRAV-D.
- Need to work on transitioning to a benchmark-free customer base (including USACE and USGS)

What is the status of GRAV-D?

NGA funded; NRL plane

USACE funded

As of January 2010
6.7% of planned areas have been flown



Federal Geospatial Summit

On proposed improvements to the NSRS: Replacing NAD 83 and NAVD 88

Date: May 11-12, 2010

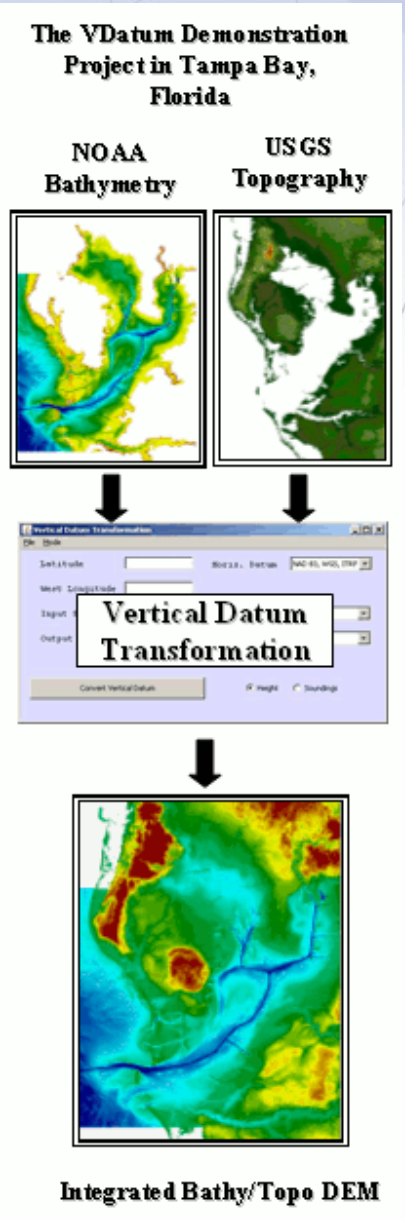
Location: NOAA Science Center, Silver Spring, MD

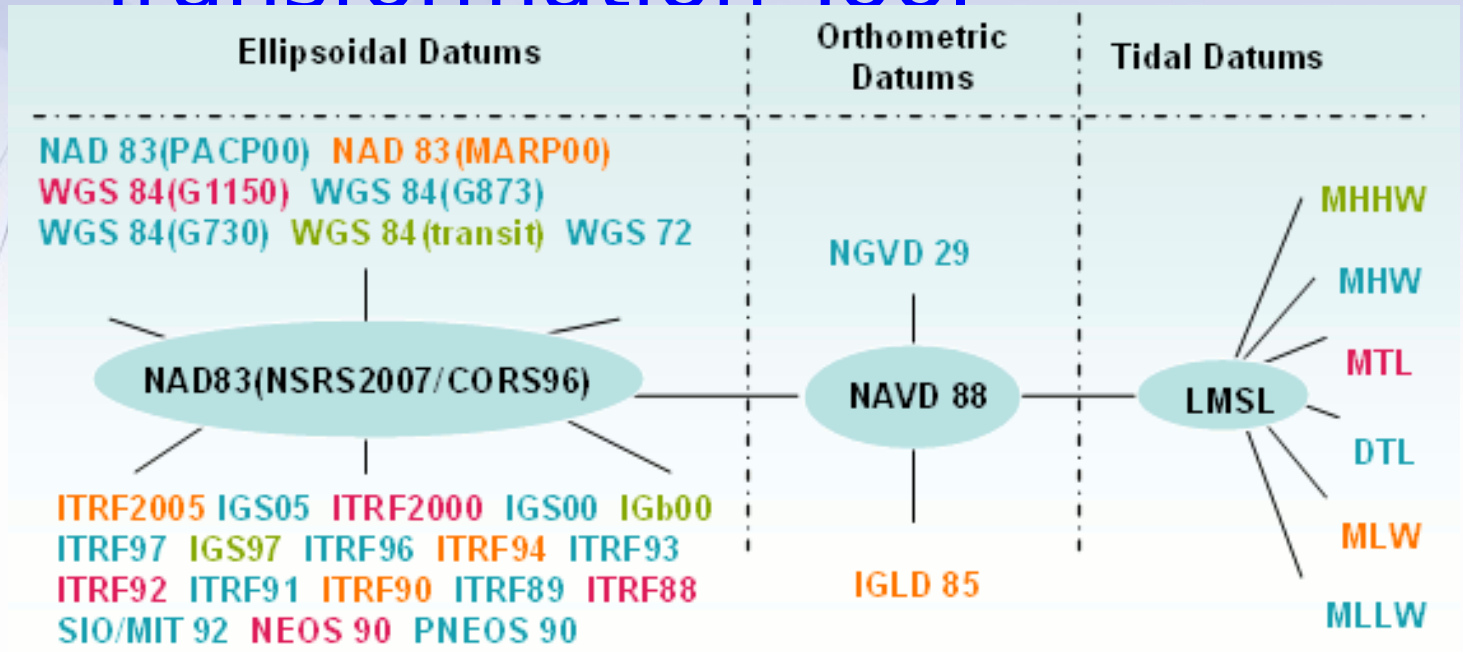
Goals:

- Disseminate the rationale leading to the decision to modernize the horizontal and vertical geodetic datums.
- Exchange information on the plans and methodologies to modernize the geometric and geopotential datums of the NSRS.
- Share concerns on how the replacement of these two datums will impact the user community.
- Outline future tasks which must be accomplished for the successful redefinition of the horizontal and vertical datums.

Participants: All federal partners

VDatum: Vertical Datum Transformation Tool

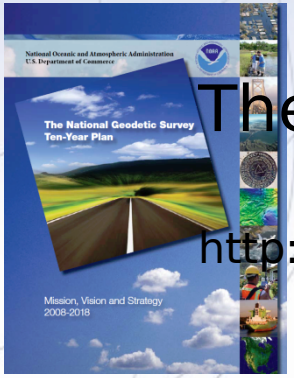




VDatum is a software tool capable of transforming coastal bathymetry and land topographic elevations between 36 different vertical datums.

http://vdatum.noaa.g

Additional Information

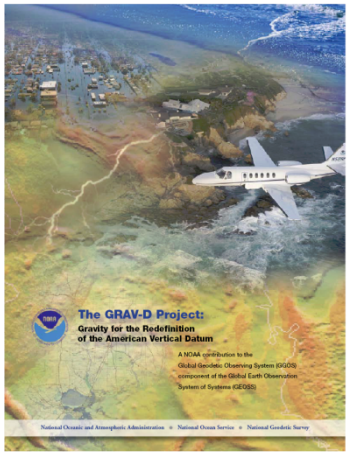


The NGS 10 year plan (2008-2018)

http://www.ngs.noaa.gov/INFO/NGS10yearplan.pdf

The GRAV-D Project

http://www.ngs.noaa.gov/GRAV-D



Socio-Economic Benefits Study:
Scoping the Value of CORS and GRAV-D
Irving Leveson
December 22, 2008
Prepared for the National Geodetic Survey

Socio-Economic Benefits of CORS and GRAV-D

http://www.ngs.noaa.gov/PUBS_LIB/Socio-EconomicBenefitsofCORSandGRAV-D.pd

Thank you